POST MORTEM

INTERVAL

(TIME OF DEATH)

http://library.thinkquest.org/04oct/00206/text_index.htm
(The Autopsy)
Rigor Mortis

![Graph showing tension over postmortem interval for different conditions (RG 37°C, WG 37°C, SO 37°C, ES 37°C, RG 25°C, WG 25°C, SO 25°C).]
Rigor Mortis

• Chemical change in the muscles after death, causing the limbs of the corpse to become stiff and difficult to move or manipulate.
  • Onset: 3-12 hours
  • Disappears after 72 hours in humans (but WHY?!)

• TEMPERATURE can have an effect!!
Rigor Mortis

- Muscles contract when myosin and actin stick together. ATP is needed to detach the two. Without ATP (in death) they cannot separate and the muscles will stay locked in a constant state of contraction!
Rigor Mortis

Occurs in all muscles simultaneously, but can sometimes be seen in smaller muscles first (face, jaw, neck; then trunk and extremities)
Livor Mortis

What might be the cause of the discoloration (darker parts) of the skin in Livor Mortis?

Why isn’t the entire backside discolored? What can this tell us about the body postmortem?
• Livor mortis – (postmortem lividity/hypostasis) the settling of blood to the dependent (lowest) parts of the body.

• Livor begins at or very soon after death (30min-2hrs) since it is a function of cardiac activity. However, stasis can occur to some extent in shock and some degree can be present even while the person is technically alive.

• The color of the dependent part will be governed by skin pigmentation and any additional compounds which may be present within the blood (i.e. carbon monoxide, etc.).

• The areas where the blood has settled will generally be dark blue or purple in color.
Livor Mortis
What can you tell about the condition of the body based on the pattern of lividity?
• What assumptions can be made about the victim based on lividity?

• If this victim was found upright in a chair, what else can be assumed?
Algor Mortis

- Algor mortis refers to *cooling of the body* postmortem.
Algor Mortis

- Postmortem body temperature ($T_{PM}$) declines progressively until it reaches the ambient temperature ($T_A$).
- Metabolism generates heat (regulated to a **narrow range**)
- The body cools at a uniform rate, thus the rate of $T_{PM}$ decrease can be used to accurately determine the time of death (TOD).
- HOWEVER…body temperature is a **narrow range, not a fixed temperature**!
- Temperature factors (maintain/raise $T_{PM}$): activity, illness, decomposition, infection and absorption of heat.
- The body cools by
  - radiation (transfer of heat to the surrounding air by infrared rays)
  - convection (transfer of heat through moving air currents)
  - conduction (transfer of heat by direct contact with another object).

- The **Glaister equation** is one formula used for determining the approximate time period since death based on body temperature:
  \[
  98.4^\circ F - \text{measured rectal temperature}(^\circ F) = \text{approximate hours since death} \times \frac{1}{1.5}
  \]

**Example:** Rectal Temperature is 88.4 deg. \(98.4 - 88.4 = 10\) degrees \(\times 1.5\) hours = 15 hours PMI.
• In average environmental conditions/temperatures, a few simple rules of thumb can be helpful:


Bernard Knight’s Formula

<table>
<thead>
<tr>
<th>Body Condition</th>
<th>PMI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Warm and flaccid</td>
<td>&lt; 3 hours</td>
</tr>
<tr>
<td>Warm and stiff</td>
<td>3-8 hours</td>
</tr>
<tr>
<td>Cold and stiff</td>
<td>8-36 hours</td>
</tr>
<tr>
<td>Cold and flaccid</td>
<td>&gt; 36 hours</td>
</tr>
</tbody>
</table>
STANDARD NOMOGRAM

1. Rectal Temperature (°C)
2. Ambient Temperature (°C)
3. Draw line connecting
4. Draw 2nd line from crosshairs through intersection
5. Mass (in kg)
6. Use 2nd crosshairs line to find TOD on the appropriate mass line
7. Apply variation
8. Count backwards from discovery to death

Victim = 100 kg

~19 hours
Many factors may influence the rate of heat loss. Careful consideration of the scene, clothing, victim size, activity and physical factors must be considered in interpreting cooling rate.

**USING CORRECTIVE FACTORS:**

Take the body mass in kg and multiply by the correction factor to get the corrected body mass due to external conditions:

\[
\text{Mass (kg)} = \text{mass of body} \times \text{CF} = \text{Mass}_c
\]
NOMOGRAM: USING CORRECTION FACTORS

1. Rectal Temperature
2. Ambient Temperature
3. Draw line connecting
4. Draw 2nd line from crosshairs through intersection
5. CALCULATE Mass (in kg)
6. Use 2nd crosshairs line to find TOD on the corrected mass line
7. Apply variations
8. Count backwards from discovery to death
<table>
<thead>
<tr>
<th>Eye Part</th>
<th>Open/Closed</th>
<th>Onset</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corneal film</td>
<td>Open</td>
<td>minutes</td>
</tr>
<tr>
<td></td>
<td>Closed</td>
<td>hours</td>
</tr>
<tr>
<td>Scleral discoloration</td>
<td>Open</td>
<td>Minutes-hours</td>
</tr>
<tr>
<td>Cornea cloudiness</td>
<td>Open</td>
<td>2 hours</td>
</tr>
<tr>
<td></td>
<td>Closed</td>
<td>Up to 24 hours</td>
</tr>
<tr>
<td>Cornea Opacity</td>
<td></td>
<td>3 days</td>
</tr>
</tbody>
</table>
Size of Meal Time in Stomach
(Starts to empty within 10 minutes)

<table>
<thead>
<tr>
<th>Meal Size</th>
<th>PMI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light</td>
<td>0.5-2 hours</td>
</tr>
<tr>
<td>Medium</td>
<td>3-4 hours</td>
</tr>
<tr>
<td>Heavy</td>
<td>4-6 hours</td>
</tr>
</tbody>
</table>
Insects and PMI

Forensic Entomology is the study of decomposer insect activity in order to give the most accurate determination of PMI.
**PMI Changes**

<table>
<thead>
<tr>
<th>Definition</th>
<th>Onset*</th>
<th>Loss*</th>
<th>External Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rigor Mortis</strong></td>
<td>Muscular contraction</td>
<td>3-12 hrs</td>
<td>72 hrs</td>
</tr>
<tr>
<td><strong>Livor Mortis</strong></td>
<td>Pooling of blood; lividity /hypostasis</td>
<td>30min - 2hrs</td>
<td>6-12 hrs it becomes fixed**</td>
</tr>
<tr>
<td><strong>Algor Mortis</strong></td>
<td>Cooling of body</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Ocular Changes**

<table>
<thead>
<tr>
<th>Change</th>
<th>Minutes-hrs</th>
<th></th>
<th>Eyes open or closed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corneal Film</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sclera Discolored</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cornea Cloudy</td>
<td>2-24 hrs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cornea Opaque</td>
<td>3 days</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Stomach Contents**

<table>
<thead>
<tr>
<th>Contents</th>
<th>Time to empty</th>
<th></th>
</tr>
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<tbody>
<tr>
<td>Light</td>
<td>0.5-2 hours</td>
<td></td>
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</tr>
</tbody>
</table>

*These are approximate figures and subject to variation

**not consistent in all cases; in some cases livor can remain unfixed for days even up until decomposition – not incredibly reliable for PMI due to variability
Additional Resources:

http://colbycriminaljustice.wikidot.com/medicolegal-investigation1

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Fig. 1. Macroscopic view of traumatic head separation with full thickness interruption of the C4–C5 cervical tract and complete resection of the spinal cord.

Fig. 2. Detail of section of the head separation where the injury edges appear generally irregular and infiltrated with blood; signs of abrasion under the chin.
What’s next?

Forensic Specialist Introduction

Forensic Specialist Project

Eyewitness testimony and types of evidence

Crime scene search & JonBenet